

BULLETIN

OF THE

CHICAGO ACADEMY OF SCIENCES

A SYNOPSIS OF THE AMERICAN FORMS OF *AGKISTRODON*
(COPPERHEADS AND MOCCASINS)

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BY

HOWARD K. GLOYD AND ROGER CONANT

For several years we have been accumulating data toward a monographic study of the snake genus *Agkistrodon*, with special reference to the American species. Most herpetological collections have been augmented appreciably during the past decade and the specimens available have become more and more numerous. Because of the strong probability (due to current events) that our study of this genus will be interrupted or postponed, we think it desirable to publish a preliminary synopsis of the New World forms, embodying the taxonomic conclusions we have reached thus far.

The American species of *Agkistrodon* form a small, compact group both geographically and morphologically. A discussion of the highly interesting geographical and evolutionary implications, which have become apparent from a consideration of the variations of these snakes, must be deferred until a detailed treatment is practicable. In this paper we are primarily concerned with matters of taxonomy: the clarification of the troublesome nomenclature of the subspecies of the copperhead, the description of a new subspecies from Trans-Pecos Texas, and the separation of two subspecies of the cottonmouth moccasin.

Both the copperhead and the cottonmouth, as species, are exceedingly homogeneous in structural characters, but four geographic races of the former and two of the latter are recognizable on the basis of differences in color and markings. These differences are clearly shown in the

accompanying photographic illustrations. Structural characters are not included in most of the diagnoses which follow but are summarized for each form in Table I (p. 168) . An exception to this occurs in the case of the new copperhead from Trans-Pecos Texas, in which there is an apparently significant higher number of caudals.

The maps show the approximate localities from which, to date, we have examined material. Each recurrence of a given symbol indicates a locality represented by one or more specimens. The localities of specimens intermediate between the different populations are indicated by a combination of the symbols representing the two subspecies in question. No previously published records have been mapped. We think, however, that the data used for these maps give a fairly clear and complete picture of the known geographic ranges of the several populations.

The key for the identification of species and subspecies will separate approximately ninety per cent of the specimens available. Individuals from areas of intergradation, of course, may be atypical.

We are sincerely appreciative of the assistance we have received from friends and colleagues in assembling data for this study. Acknowledgments in full will be given in a later paper.

THE COPPERHEADS

In order to make clear the necessity for changes in the nomenclature of the subspecies of the copperhead it is desirable to summarize the recent taxonomic history of this species. For many years the specific name *contortrix* of Linnaeus (1766, p. 373) was associated with the copperhead. Stejneger and Barbour (1917, p. 76, footnote), however, concluded that *Boa contortrix* Linnaeus is identifiable with a common species of hog-nosed snake (*Heterodon contortrix*) and they further (*op. cit.*, p. 106) considered *Agkistrodon mokasen* Beauvois (1799, p. 370) to be the next oldest name applicable to the copperhead.

In 1934 the present authors described the broad-banded copperhead, *Agkistrodon mokasen laticinctus*, and in 1938 we reviewed the species, recognizing three forms and publishing diagnoses of each. It was realized then that the status of Beauvois' *mokasen* is vague, but, in an effort to avoid introducing a new name into the literature, we applied *mokasen* (*Agkistrodon mokasen mokasen* Beauvois) to a southern subspecies on the assumption, now known to be untenable, that Beauvois had referred to a snake belonging to that population. For the northern subspecies we revived *cupreus* of Rafinesque (1818, p. 84) , an appropriate name with which is associated an unmistakable description and a definite type locality.

Pertinent information concerning the travels of Beauvois has recently been called to our attention by Dr. Francis Harper and by Dr. E. R. Dunn. It appears certain that Beauvois never visited Louisiana and, consequently, our choice of a specimen from Gentilly, Louisiana (Chicago Acad. Sci. 5089) , as a neotype of Beauvois' *mokasen* was unfortunate. Accordingly, we have restudied the entire situation, discussing it with several others of our colleagues, including Karl P. Schmidt and Clifford H. Pope, and have reached the following conclusions:

1. The name of the genus *Agkistrodon* Beauvois (1799, p. 381) probably is valid. Beauvois' diagnosis fits the genus as we know it and from the context of his article it is clear that he was dealing with snakes from within the present United States.
2. The specific name *mokasen* Beauvois (op. cit., p. 370) is not certainly identifiable with the copperhead and is, in fact., a *nomen nudum* which should be discarded.
3. The earliest binomial specifically applicable to the copperhead is *Cenchrus mokeson* Daudin (1803, p. 358, pl. LX, fig. 25 ; pl: LXX, fig. 3 and 4). Daudin's diagnostic comments, descriptive notes, and figures define the species sufficiently for recognition. Possible application of *mokeson* to the cottonmouth is ruled out by the high number of ventrals mentioned (157) and by the fact that he treated the latter species separately (*Scytale piscivorus*, p. 344) .
4. Since Daudin (*loc. cit.*) gives a brief description based on a drawing of a copperhead by Peale of Philadelphia, the type locality for the species can be, stated as the vicinity of Philadelphia, Pennsylvania.
5. The Philadelphia region is well within the geographic range of the northern subspecies, outlined by us (1938, p. 164) under the name (**Rafinesque**) , and can be restricted to this population which may now be known as (Daudin). Rafinesque's *cupreus* again becomes a synonym.
6. The above procedure leaves the southern subspecies diagnosed by us (1938, p. 164) under the name *A. mokasen mokasen* Beauvois without a subspecific name. A new one is proposed in this paper.

Agkistrodon mokeson mokeson (Daudin)

Northern Copperhead

Figures 1 and 7

Cenchrus mokeson DAUDIN, 1803, p. 358, pl. LX, fig. 25; pl. LXX, fig. 3, 4.

Scytalus cupreus RAFINESQUE, 1818, p. 84.

Acontias (Toxicophis) atro-fuscus TROOST, 1836, p. 181, 190.

Agkistrodon contortrix BAIRD AND GIRARD, 1853, p. 17 (part) .-STEJNEGER, 1895, p. 40 (part).

Ancistrodon contortrix BAIRD, 1854, p. 13.—COPE, 1859, p. 336 (part) ; 1900, p. 1135 (part).

Agkistrodon mokasen STEJNEGER AND BARBOUR, 1917, p. 106 (part) ; 1923, p. 120 (part) ; 1933, p. 131 (part).

Agkistrodon mokasen mokasen GLOYD AND CONANT, 1934, p. 2 (part).

Agkistrodon mokasen cupreus GLOYD AND CONANT, 1938, p. 164, fig.

2. STEJNEGER AND BARBOUR, 1939, p. 144.-SCHMIDT AND DAMS, 1941, p. 284.

Type Locality.-----The vicinity of Philadelphia, Pennsylvania.

Diagnosis. Coloration reddish brown or chestnut, sometimes with little contrast between pattern and ground color ; specimens from some localities finely stippled with gray or brown, and occasionally marked with small round or irregular spots between the crossbands. Pattern of broad, dark crossbands, variously described as "spool-shaped" or "dumb-bell-shaped," constricted middorsally (3 to 5 scale lengths in width) , and rounded off at the ends above the ventrals (Fig. 7) ; a ventrolateral pattern of more or less distinct, subcircular blotches. Belly usually dark, mottled with gray or black.

Range. Upland areas of eastern Oklahoma, eastern Kansas, and southeastern Nebraska, northwestern Arkansas (Ouachita and Ozark plateaus) , Missouri (except southeastern part) , north to extreme south-eastern Iowa, central Illinois, south-central Indiana, southern and eastern Ohio, Pennsylvania, southeastern New York, Connecticut, and eastern Massachusetts; the Appalachian highlands south to northeastern Alabama and the valley of the Tennessee River in Tennessee and Kentucky (Map 1) .

Specimens intergrading with the adjacent subspecies (*A. m. austrinus*) to the south and east are known from eastern Oklahoma, southeastern Missouri, southern Illinois, western Tennessee, northeastern Alabama, and several localities in the Piedmont and Atlantic Coastal Plain. Specimens intergrading with the broad-banded form (*A. m. laticinctus*) to the southwest are known from eastern Oklahoma and northeastern Texas (Map 1, p. 153) .

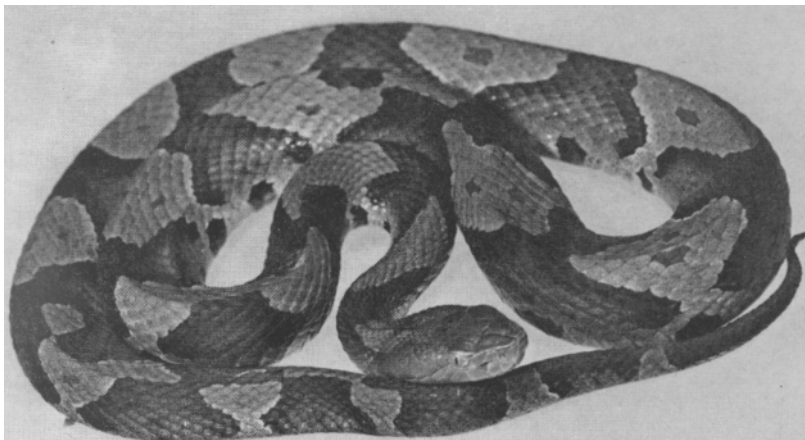


Fig. 1. *A. m. mokeson*, Dutchess County, New York. Chicago Acad. Sci. 11322.

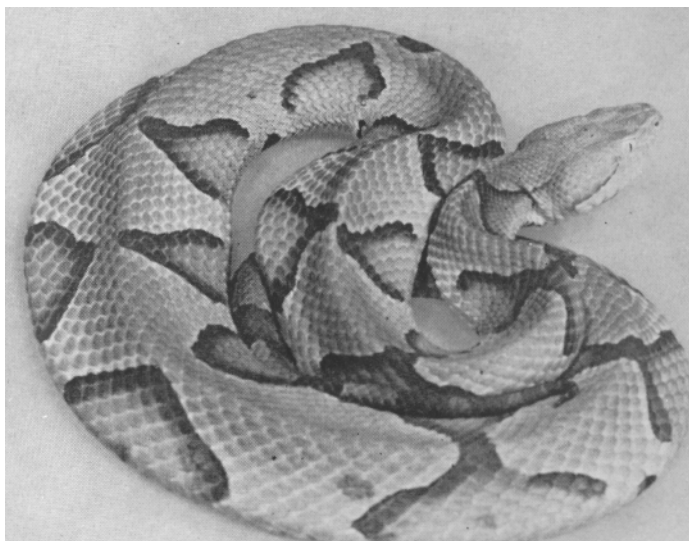


Fig. 2. *A. in. austrinus*, Gentilly, Orleans Parish, Louisiana. Toledo Zool. Soc.

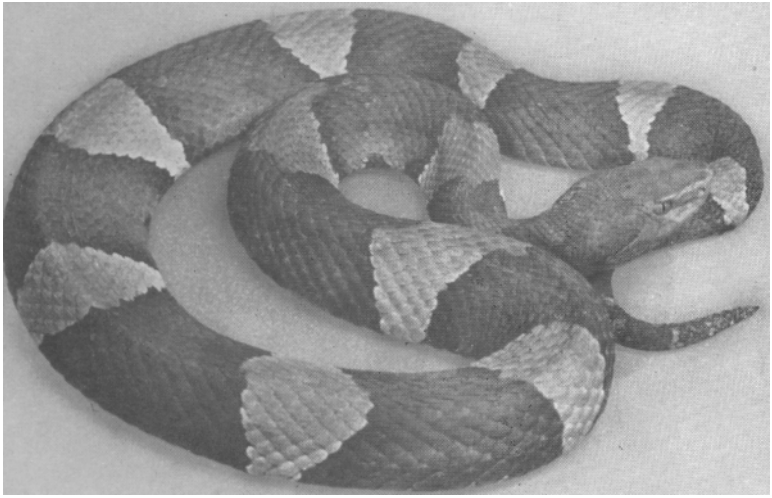


Fig. 3. *A. m. laticinctus*, Bexar County, Texas. Mus. Zool. Univ. Michigan 75599 (Type specimen).

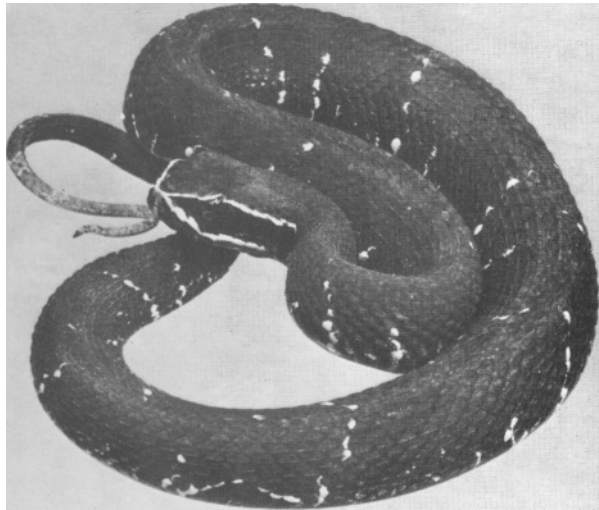
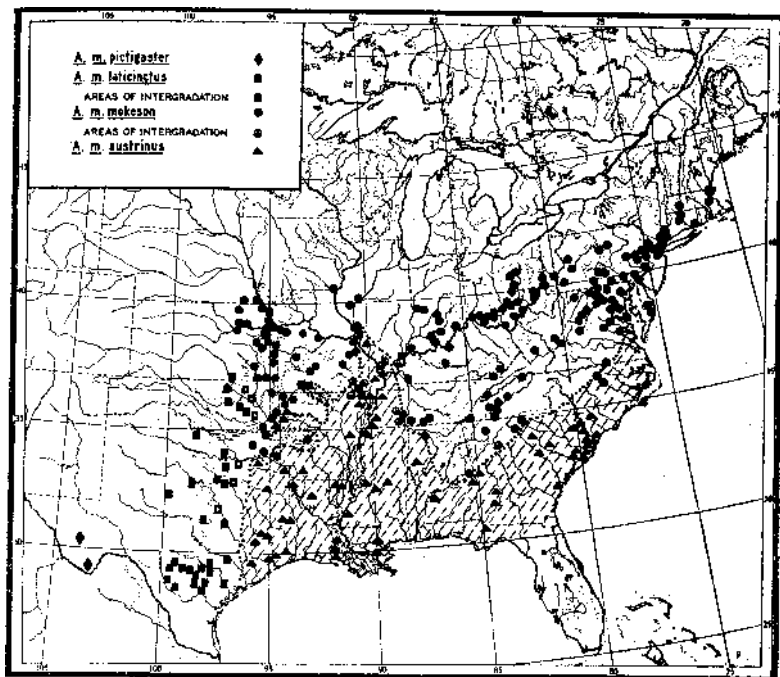


Fig. 4. *A. bilineatus*, Colima. Toledo Zoo]. Soc.



Map 1. Geographic distribution of the subspecies of the copperhead, *Agkistrodon mokeson*. Dotted line and hatched area separate the range of *A. m. austrinus*. Areas of intergradation are indicated by a combination of the symbols representing the subspecies concerned.

Agkistrodon mokeson austrinus, new name

Southern Copperhead; Lowland Copperhead

Figures 2 and 8

A. gkistrodon contortrix BAIRD AND GIRARD, 1853, p. 17 (part).-STEJNEGER, 1895, p. 40 (part).

A. ncistrodon contortrix COPE, 1859, p. 336 (part); 1900, P. 1135 (part).

Agkistrodon mokeson STEJNEGER AND BARBOUR, 1917, p. 106 (part); 1923, p. 120 (part); 1933, p. 131 (part).

A. gkistrodon mokeson mokeson GLOYD AND CONANT, 1934, p. 2 (part); 1938, p. 164, fig. 1.-STEJNEGER AND BARBOUR, 1939, p. 144.-SCHMIDT AND DAVIS, 1941, p. 283.

Type Locality. Gentilly, Orleans Parish, Louisiana. Type specimen Chicago Acad. Sci. 5089, adult female, collected by Percy Viosca, Jr., 1933.

Diagnosis. General coloration pale brown or tan, sometimes with a pinkish tinge in life; ground color usually much lighter than markings. Pattern of light brown crossbands, "hour-glass-shaped," strongly constricted middorsally (2 or 3 scale lengths in width), often irregular or not meeting at the midline (Fig. 2), and rounded off at the ends well above the ventrals (Fig. 8); a ventrolateral pattern of spots, the more distinct ones alternating with the crossbands. Belly pale, not heavily marked.

Description of Holotype.—*Head* shields arranged as in other members of the species; paired and bilaterally symmetrical internasals, prefrontals, supraoculars, and parietals, the parietals short and irregular posteriorly; a single rostral and frontal. A small anomalous scale cut off from the anterodextral corner of the frontal; another, much smaller, azygous scale at the posterior tip of the frontal and wedged in between the parietals. Nasals 2, the anterior one larger and with the nostril entirely within it. Loreal rather small, about as long as high. Three preoculars, the uppermost largest, the middle one forming the upper posterior border of the pit, and the lowermost very small. Separated from the orbit by the last is an elongate scale which forms the lower posterior border of the pit. Postoculars and suboculars continuous, 5 in all. Supralabials on left side 8, the third and fourth largest, the fourth directly below the eye; on right 7, the fourth largest and elongated backward along the commissure where it meets the sixth, thus cutting off the fifth from the mouth. The second supralabial on each side is elongated upward, forming the anterior border of the pit. Infralabials 10. Temporals small and irregular, 5 or 6 in each vertical row. The first pair of infralabials meet on the ventral line immediately posterior to the mental. A single pair of elongated chin shields, followed by 4 small scales anterior to the first ventral. Infralabials separated from the first ventral by 5 rows of scales.

Dorsal scales with two apical pits. Scale rows 25-23-21, all carinate throughout the length of the body; irregular in number on neck (counts are 30, 29, 27, and 26). The rest of the scalation, expressed in the Clark and Inger (recount) System (Copeia, 1942, p. 163-170), is as follows:

$$\begin{array}{rcccl}
 & 24 & & 110 & \\
 25 & \frac{(5+6)}{(5+6)} & 23 & \frac{(4+5)}{(4+5)} & 21 \\
 & 24 & & 110 &
 \end{array}$$

The ventrals are 151 plus an undivided anal plate; caudals 42, the last 3 divided. The terminal spine is as long as the three divided caudals.

Dorsal ground color pale pinkish brown. Dorsal bands light chestnut; the centers of the broad portions on the sides paler, not much

darker than the ground color. All of the dorsal surface and almost all of head minutely stippled with light brown, the stippling darkest and somewhat concentrated on the borders of the dorsal bands. Top of head and temporal region light chestnut. Supralabials and lower part of rostral pale pinkish brown. Last eight infralabials uniform pale yellowish along the commissure, a fairly regular brownish band running along their lower halves. First two infralabials and mental similar in coloration, but considerably stippled. Chin and throat pale yellowish cream, somewhat stippled with a slightly darker shade.

Dorsal markings 15 in number on the left side and 13 on the right ; several fail to meet their partners on the opposite side and accordingly several of the crossbands are incomplete. Those which are complete are strongly constricted on the middorsum, averaging 2 scales wide in this region and 6 or 7 scales wide on the sides. Markings widest, and rounding off, on the second and third rows of scales.

A series of dark rounded spots on the first row of scales and the adjacent edges of the ventrals, each spot situated about midway between each adjacent pair of dorsal markings. Spots quite dark on their upper edges (these spots, in toto, are the darkest and the most conspicuous markings on the specimen) . Smaller, less prominent spots on the belly ; one, two or three of these centered below each dorsal marking. Remainder of belly pale yellowish, considerably stippled with light brown, especially toward the sides.

Tail similar to body in general pattern and coloration but with the markings irregular. Posterior two-fifths of tail heavily stippled above with dark brown.

Range. Lowland areas of the lower Mississippi Valley and the Gulf and Atlantic Coastal Plains from eastern Texas north to southern Illinois, and probably to southern Maryland ; not found in peninsular Florida (Map 1, p. 153) .

This **subspecies apparently occurs in the valley of the White River of Arkansas as far north as southern Missouri, and in the valley of the Arkansas River in eastern Oklahoma.**

Areas of intergradation between *austrinus* and *mokeson* have been mentioned under *A. m. mokeson*. The range of *austrinus* approaches that of *A. m. laticinctus* in eastern Texas but no indication of intergradation with this form is evident.

The occurrence of *austrinus* in southern Maryland is not as yet definitely substantiated. We have examined a fragment of a copperhead, found on a road in St. Mary's County by Dr. Robert H. McCauley, Jr. in 1936, which has crossbands characteristic of this subspecies. Dr. McCauley (*in Litt.*) mentions having seen two additional

specimens from this area which strongly resemble more southern examples of this population, and Frank Groves, of Baltimore, reports finding copperheads in extreme southern Maryland which resemble typical specimens of *austrinus*. Additional material from the coastal plain of Maryland, Virginia, and North Carolina is much desired.

***Agkistrodon mokeson laticinctus* Gloyd and Conant**

Broad-banded Copperhead

Figures 3 and 9

Agkistrodon mokeson laticinctus **GLOYD AND CONANT**, 1934, p. 2 (part), pl. 1, fig. 1, 2; 1938, p. 165 (part), fig. 3.-**STEJNEGER AND BARBOUR**, 1939, p. 145 (part).—**SCHMIDT AND DAVIS**, 1941, p. 284 (part).

Type Locality. Twenty-six miles northwest of San Antonio, Bexar County, Texas. Type specimen Mus. Zool. Univ. Michigan 75599, adult male, collected by R. F. Harvey, 1933.

Diagnosis. Coloration usually bright chestnut or hazel brown, with marked contrast between pattern and ground color; crossbands strikingly broad (7 to 14 scales wide on sides at first row of scales, 4 to 8 scales wide at the middorsal line), and extending downward laterally to the ventrals where they blend with the ventrolateral pattern of three more or less conspicuous spots to each crossband (Fig. 3 and 9).

Range. Central and north-central Texas and central Oklahoma, north to Cowley County, Kansas (Map 1, p. 153).

Intergradation with *A. m. mokeson* occurs in northeastern Texas and eastern Oklahoma, but there is no indication of intergradation with *A. m. austrinus*.

***Agkistrodon mokeson pictigaster*, new subspecies**

Trans-Pecos Copperhead

Figure 10

Agkistrodon mokeson laticinctus **GLOYD AND CONANT**, 1934, p. 2 (part); 1938, p. 165 (part).—**STEJNEGER AND BARBOUR**, 1939, p. 145 (part).—**AND DAVIS**, 1941, p. 284 (part).

Diagnosis. Similar to *A. m. laticinctus* in dorsal pattern but differ in the very dark and strikingly patterned belly. Undersurface dark brown, deep chestnut, or black, relieved by light, strongly-contrasting

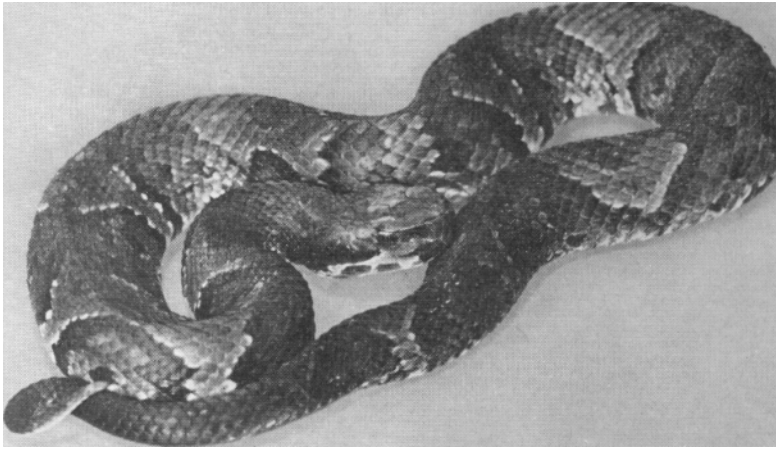
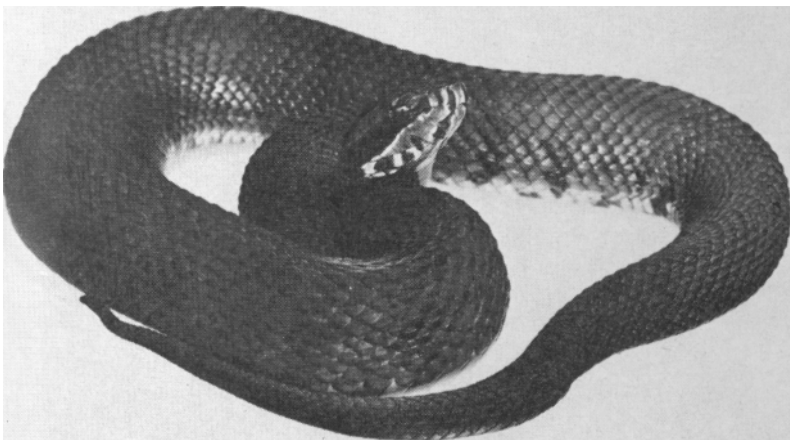


Fig. 5. *A. p. leucostoma*, small adult, length 71(1 mm., Stoddard County, Missouri.
Chicago Acad. Sci. 8174.



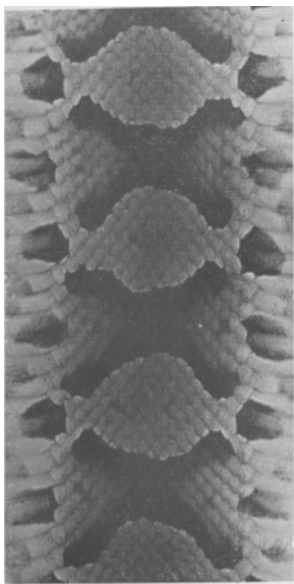


Fig. 7. *A. m. mokeson*, Dutchess County, New York. Chicago Acad. Sci. 11323.

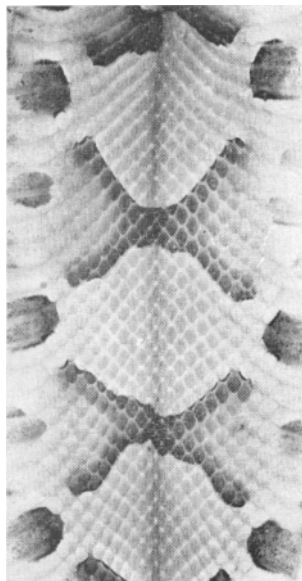


Fig. 8. *A. m. austrinus*, Gentilly, Orleans Parish, Louisiana. Chicago Acad. Sci. 5089 (Type specimen).

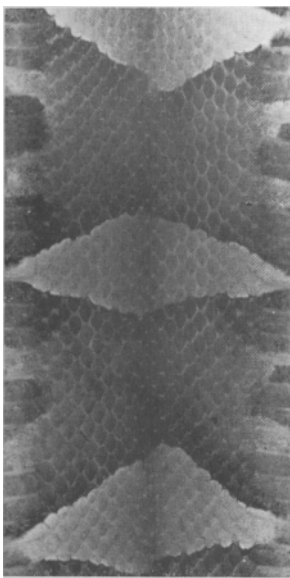


Fig. 9. *A. m. laticinctus*, Bexar County, Texas. Mus. Zool. Univ. Michigan 75599 (Type specimen).

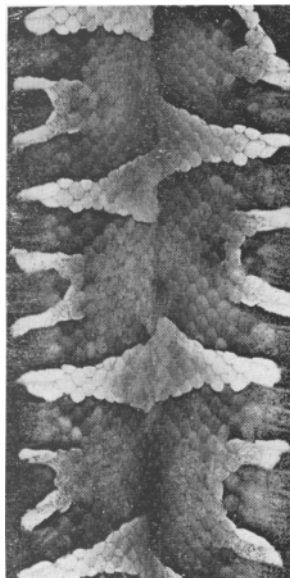


Fig. 10. *A. m. pictigaster*, Chisos Mountains, Brewster County, Texas. Chicago Acad. Sci. 7807.

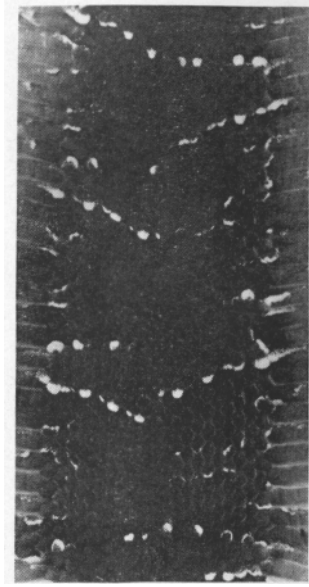


Fig. 11. *A. bilineatus*, adult, length 745 mm., Tecoman, Colima. Chicago Acad. Sci. 11333.

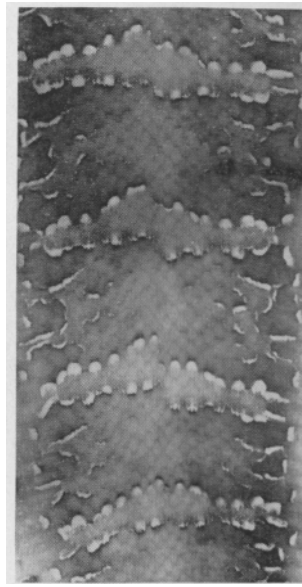


Fig. 12. *A. bilineatus*, juvenile, length 285 mm., Merida, Yucatan. Field Mus. Nat. Hist. 19425.

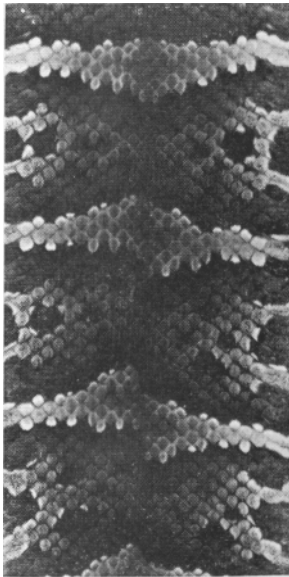


Fig. 13. *A. p. leucostoma*, subadult, length 455 mm., Jackson County, Illinois. Illinois St. Nat. Hist. Surv. 1809.

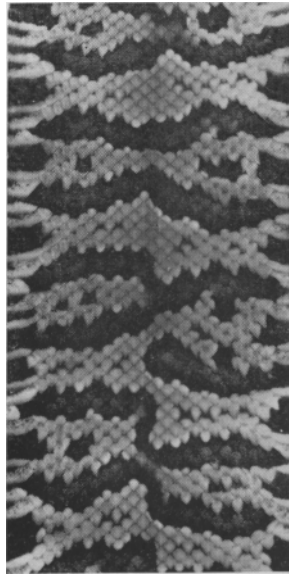


Fig. 14. *A. p. piscivorus*, subadult, length 580 mm., Grady County, Georgia. Chicago Acad. Sci. 10805.

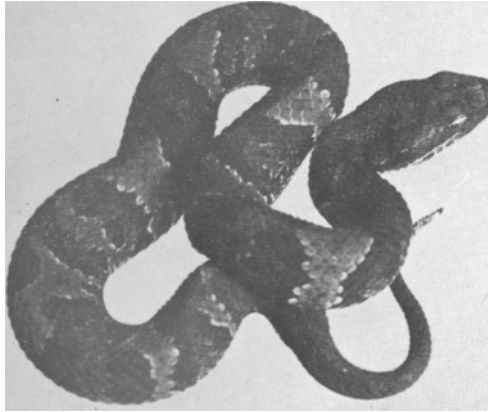


Fig 15. *A. p. leucostoma*, subadult, length 385 mm., Union County, Illinois.
Illinois St. Nat. Hist. Surv. 1812.

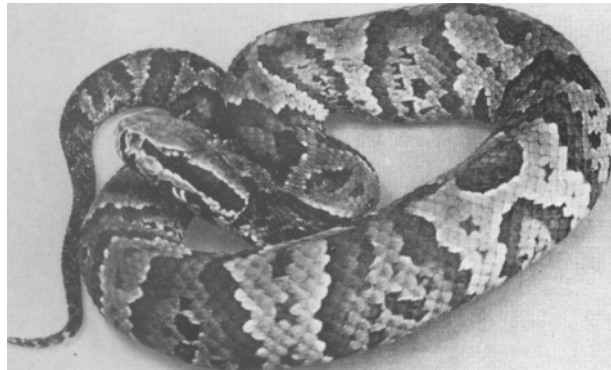


Fig. 16. *A. p. piscivorus*, subadult, length 500 mm., Lee County, Georgia.
Mus. Zool. Univ. Michigan 72806.

areas extending onto belly from the dorsal ground color, and by similar light areas (often in the form of an inverted "U") below each dark dorsal crossband (Fig. 10) . A structural difference of possible diagnostic value is the higher number of caudals: 57 to 59 in males, 52 to 56 in females. In no other specimens of the copperhead examined to date does the number of caudals exceed 54 in males **or** 52 in females (Table I, p. 168).

Type Specimens. Holotype, Chicago Acad. Sci. 4857, adult male, Maple Canyon, Chisos Mountains, elevation 5200 feet, Brewster County, Texas; collected by W. L. Necker, July 28, 1937. Paratypes: Chicago Acad. Sci. 7807, Oak Spring, Chisos Mountains, U. S. Nat. Mus. 103659, Pulliam Canyon, Chisos Mountains, Brewster County, Texas ; Mus. Zool. Univ. Michigan 72246, Tippet's Ranch, near Mitre Peak, Cornell Univ. Mus. 913, Musquiz Canyon, north of Alpine, Jeff Davis County, Texas.

Description of Holotype. Head shields arranged as in other members of the species : paired and bilaterally symmetrical internasals, prefrontals, supraoculars, and parietals, and a single rostral and frontal; parietals irregular posteriorly. Nasals 2, the anterior larger and with the nostril entirely within it. Loreal about as long as high. Three preoculars, the uppermost largest, the middle one forming the upper and posterior borders of the pit, and the lowermost very small. Separated from the orbit by the last is an elongate scale which forms the lower border of the pit. Postoculars and suboculars continuous, 5 in all. Supralabials 8, the third, fourth, and fifth about equal in size; the fourth directly below the eye; the second elongated upward and forming the anterior border of the pit. Infralabials 9 on the left side and 10 on the right ; the most posterior one on each side very small. Temporals small and irregular, 4 to 6 in each vertical row. The first pair of infralabials meet on the ventral line immediately posterior to the mental. A single pair of elongated chin shields followed by about five irregular rows of small scales anterior to the first ventral. Infralabials separated from the first ventral by five rows of scales.

Dorsal scale rows 25-23-21-19, all carinate throughout the length of the body. Scalation, expressed in the Clark and Inger (recount) System (*op. cit.*) as follows:

$$\begin{array}{ccccccc}
 & & 22 & & 69 & & 102 \\
 & & (4+5) & & (5+6) & & (4+5) \\
 25 & & (4+5) & 23 & (4+5) & 21 & (4+5) & 19 \\
 & & 23 & & 73 & & 103
 \end{array}$$

The ventrals are 152, plus an undivided anal plate; subcaudals 59, the last 21 divided. Terminal spine short and blunt and scarcely protruding beyond the last pair of subcaudals.

Dorsal ground color light hazel brown, minutely stippled with darker brown. Dorsal bands deep chestnut brown, similarly stippled and narrowly bordered with very dark brown. Top of head and temporal region deep chestnut. Rostral, nasals, loreals, preoculars, suboculars, and anterior supralabials similar to dorsal ground color. A very narrow brown line, starting at the posterolateral corner of the eye, separates the chestnut brown of the temporal region from a much lighter (cream-colored) area on the lower portions of the posterior supralabials. The narrow brown line turns sharply forward slightly beyond the angle of the mouth and continues forward through the median portions of the infralabials as far as the second one, thus leaving the upper portion of each to form (collectively) a light border along the lower edge of the mouth. The resultant coloration of the mouth is suggestive of that of blackface minstrels whose lips are wide and light in color, immediately followed by a much darker shade. Chin and throat yellowish cream, heavily mottled with light brown.

Dorsal crossbands 13 in number (the first continuous with the darker portions of the head) ; wide and almost straight-sided, averaging 9 scales in width on the sides and 8 on the midline ; continuous across the back in most cases, but the lateral halves of some do not quite match with their respective partners. The bands are continuous with the belly pattern ; adjacent bands meet at their lower extremities, the narrow dark border of one turning at the ventrals and continuing up onto the next, thus cutting off the ground color from the belly. Under the center of each band is a light area, shaped like an inverted "U" and about equal in tone to the ground color ; the downward-pointing arms of the "U" are short and wide, but the "curve" is narrower and fades imperceptibly into the coloration of the dorsal bands. The rest of the belly is very dark brown, heavily stippled with still darker shades of brown and black.

Range. Known only from the type series, from the southern part of Jeff Davis County and the Chisos Mountains in Brewster County, Texas (Map 1, p. 153).

THE MOCCASINS

The Mexican moccasin, *A. bilineatus*, is apparently quite distinct from all other species. Interesting distributional and ecological problems are suggested by its wide-spread occurrence in Mexico and Central America but sufficient material is not yet available for a satisfactory study of its geographic variation. Recently collected specimens from Sonora (C. M. Bogert), Coahuila (E. G. Marsh, Jr.) and Nuevo Leon (Taylor, 1940) extend its known range considerably to the north.

Geographic differences in the cottonmouth moccasin, *A. piscivorus*, have been frequently noted and are reflected in the works of earlier writers on North American reptiles. Our study of 420 specimens, representing nearly all parts of the known range of this species, indicates that two geographic races are readily separable.

Agkistrodon bilineatus Gunther

Mexican Moccasin; Cantil

Figures 4, 11, and 12

Agkistrodon bilineatus GUNTHER, 1863, p. 364.—COPE, 1887, p. 89.—GÜNTHER, 1895, p. 186, pl. 58, fig. A and B.—BOULENGER, 1896, p. 521.—MOCQUARD, 1909, p. 935.

Trigonocephalus bilineatus BOCOVRT, 1882, pl. 27.

Type Locality. Pacific Coast of Guatemala. Type specimen in British Museum, collected by O. Salvin.

Diagnosis. General coloration dark brown or black in adults, brown in juveniles; two prominent white or yellow lines on each side of head, both starting at tip of snout, one extending backward along canthus over eye to temporal region, the other obliquely downward and backward over supralabials to angle of mouth (Fig. 4); dorsal crossbands incompletely bordered with white spots and, in adults, obscured by the general darkening of the ground color (Fig. 4 and 11); in juveniles the dorsal crossbands are distinct from the ground color and resemble those of *A. m. laticinctus* and, *A. m. pictigaster* (Fig. 12); loreal present; scale rows 23; caudals 59-68 (average 63) in males, 56-64 (average 59) in females.

Range. Mexico: Southern Sonora, east-central Coahuila, southern Sinaloa, Tepic, Maria Madre Island, Colima, Michoacan, Guerrero, Oaxaca, Chiapas, and Yucatan. Reported from Jalisco (Guadalajara, Cope, 1865, p. 191) and Nuevo Leon (Taylor, 1940, p. 486). Central America: Guatemala, British Honduras, and Nicaragua (Map 2, p. 165).

Agkistrodon piscivorus leucostoma (Troost)

Western Cottonmouth

Figures 5, 13, and 15

Acontias leucostoma TROOST, 1836, p. 176, pl. 5, fig. 1-4 (*Toxicophis* substituted for *Acontias*, *ibid.*, p. 190).

Toxicophis pugnax BAIRD AND GIRARD, 1853, p. 20, 156.

Ancistrodon piscivorus COPE, 1859, p. 336 (part) ; 1892, p. 683 (part) ; 1900, p. 1133 (part).

Ancistrodon piscivorus piscivorus COPE, 1875, p. 34 (part).

Ancistrodon piscivorus pugnax COPE, 1875, p. 34.

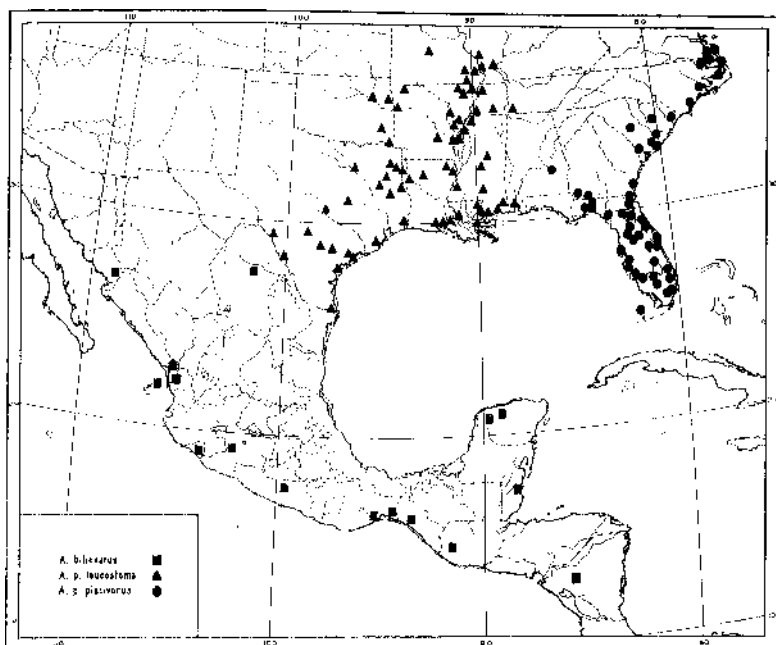
Agkistrodon piscivorus STEJNEGER, 1895, p. 406 (part) .---STEJNEGER AND BARBOUR, 1917, p. 107 (part) ; 1923, p. 121 (part) ; 1933, p. 131 (part) ; 1939, p. 145 (part).--SCHMIDT AND DAVIS, 1941, p. 285 (part).

Type Locality.—Western Tennessee. Type specimen probably non-extant. Neotype : Chicago Acad. Sci. 5604, adult male, collected 10 miles northeast of Bolivar, Hardeman County, Tennessee, by W. F. Ross., August, 1935.

Diagnosis. General coloration, in both adults and juveniles, dark brown or black above, and usually below ; dorsal ground color usually almost as dark as markings; crossbands broad, with dusky centers, little if any invaded by ground color (Fig. 5, . 13, 15) rostral and sides of snout dark, with no' distinct vertical dark lines at sides of rostral (Fig. 5) * juveniles dark with little contrast - between markings and ground color (Fig. 13, 15).

The displacement or reduction of the second supralabial by an anterior extension of the third, a character used by Baird and Girard (1853, p. 20) as diagnostic of *pugnax* from the Gulf Coast of Texas, occurs in several localities but not with a sufficiently high frequency to be employed in characterizing this population.

Range. The valley of the Rio Grande (Mouth of Devil's River and Eagle Pass) and the' Gulf Coastal Plain of Texas, Louisiana, and Mississippi, eastward at least to the vicinity of Mobile, Alabama ; . north in the Mississippi Valley through western • Tennessee to southern Illinois, and west as far as Miller County, Missouri, and eastern Oklahoma (Map 2).



Map 2. Geographic distribution of the cantil, *Agkistrodon bilineatus*, and the subspecies of the cottonmouth, *A. piscivorus*.

A cottonmouth found dead at the edge of a highway near Chillicothe, Livingston County, Missouri, has been reported by Anderson (1941, p. 178). There is no apparent reason for doubting the occurrence of the species in this more northern locality, but it seems best to await verification in the form of additional specimens before regarding this region as part of its natural range.

In the material we have thus far examined there are no specimens which show intergradation between this subspecies and *A. p. piscivorus*. However, such specimens logically may be expected from southern Alabama and extreme western Florida.

Agkistrodon piscivorus piscivorus (Lacépède)

Eastern Cottonmouth

Figures 6, 14, and 16

Crotalus piscivorus **LACÉPÈDE**, 1789, table meth., p. 130.

Ancistrodon piscivorus **COPE**, 1859, p. 336 (part) ; 1892, p. 683 (part) ; 1900, p. 1133 (part).

Ancistrodon piscivorus piscivorus **COPE**, 1875, p. 34 (part).

Agkistrodon piscivorus **STEJNEGER**, 1895, p. 406 (part) .-**STEJNEGER AND BARBOUR**, 1917, p. 107 (part) ; 1923, p. 121 (part) ; 1933, p. 131 (part) ; 1939, p. 145 (part).-**SCHMIDT AND DAVIS**, 1941, p. 285 (part).

Type Locality. Carolina.

Diagnosis. General coloration olive, brown, or black above; belly light; crossbands with more or less distinct dark borders, the centers invaded by ground color, often giving the effect of narrow, paired, transverse bars (Fig. 14 and 16) ; pattern usually obsolete in large adults; rostral and sides of snout light, usually with a distinct vertical dark line at each side of rostral (Fig. 6 and 16) ; juveniles light, with brilliant patterns sharply contrasting with ground color (Fig. 16) .

Range. Gulf and Atlantic Coastal Plains from southeastern Alabama, throughout Florida (including coastal islands), north to extreme southeastern Virginia (Map 2, p. 165) .

KEY TO AMERICAN SPECIES AND SUBSPECIES OF *AGKISTRODON*

1. Scale rows 23; loreal present. 2
Scale rows 25; loreal absent. 9
2. Coloration chiefly some shade of chestnut or reddish brown (in both adults and juveniles) ; no prominent white line extending from rostral over eye to temporal region. 3
Coloration black or dark brown (reddish brown in juveniles) ; a prominent white or yellow line extending from rostral over eye to temporal region; another white or yellow line extending backward and downward from rostral to angle of mouth (Fig. 4) .

A. bilineatus.

3. Dorsal markings of body in the form of dark, transverse "dumb-bells" or "hour-glasses," considerably narrower on the middorsum than on the sides, and rounded off at the ends, not continuous with the dark markings of the belly. 4

Dorsal markings consisting of broad, dark crossbands, not much narrower on the middorsum than on the sides of the body, and continuous with the dark markings of the belly. 5

4. Dorsal markings strongly constricted at middorsum (2 or 3 scale-lengths in width), often divided and irregular; general coloration pale, sometimes pinkish; ventral markings usually not in strong contrast with ground color (Fig. 2 and 8) .

A. mokeson austrinus.

Dorsal markings not strongly constricted at middorsum (3 to 5 scale-lengths in width), seldom divided; general coloration usually reddish brown or chestnut, often finely stippled with gray or brown; ventral markings usually in marked contrast with ground color (Fig. 1 and 7). *A. mokeson mokeson.*

5. Belly very dark; almost uniform black or heavily mottled, the dark markings predominating (Fig. 10) ; caudals 57 or more in males, 52 or more in females. *A. mokeson pictigaster.*

Belly not conspicuously dark; markings usually fairly well defined (Fig. 3 and 9); caudals less than 54 in males, 52 or less in females. *A. mokeson laticinctus.*

General coloration olive, brown, or black above, belly light; crossbands with dark borders more or less distinct, and centers of crossbands invaded by ground color (Fig. 6 and 14) ; rostral and sides of snout light, usually with a distinct vertical dark line at each side of rostral (Fig. 6 and 16) ; juveniles light, with sharply defined markings (Fig. 16) . *A. piscivorus piscivorus.*

General coloration usually dark brown or black above and below, in both adults and juveniles; crossbands broad with dusky centers, little if any invaded by ground color (Fig. 5 and 13) ; rostral and sides of snout dark, with no distinct vertical dark lines (Fig. 5) ; juveniles dark with little contrast between markings and ground color (Fig. 15) . *A. piscivorus leucostoma.*

Table I. Summary of Structural Characters in American Forms of *Agkistrodon*.
Averages in parentheses.

	Number of Specimens	Scale Rows	Ventrals	Caudals	Supra- labials	Infra- labials	Bands on Body
<i>mokeson</i>	820	23	♂ 141-156 (148) ♀ 140-157 (148)	38-52 (46) 38-49 (44)	6-10 (8)	8-12 (10)	12-19 (14) 12-20 (15)
<i>austrinus</i>	210	23	♂ 141-154 (149) ♀ 143-155 (149)	41-51 (46) 38-49 (43)	7-9 (8)	8-11 (10)	12-18 (14) 11-17 (14)
<i>laticinctus</i>	126	23	♂ 143-153 (147) ♀ 143-154 (147)	44-54 (48) 37-52 (45)	6-10 (8)	8-11 (10)	10-15 (13) 10-15 (13)
<i>pictigaster</i>	5	23	♂ 152, 153 ♀ 150	57-59 (58) 52-56 (54)	7-8 (8)	9-10 (10)	13-16 13-15
<i>bilineatus</i>	46	23	♂ 131-144 (135) ♀ 129-143 (135)	59-68 (63) 59-64 (59)	8-9 (8)	10-13 (10.5)	*10-17 (13)
<i>leucostoma</i>	301	25	♂ 130-139 (134) ♀ 130-142 (134)	38-49 (44) 37-48 (42)	6-11 (8)	8-13 (11)	11-16 (12.5) 10-16 (12.2)
<i>piscivorus</i>	119	25	♂ 130-144 (137) ♀ 130-141 (137)	42-53 (48) 41-49 (44)	7-9 (8)	8-12 (10.4)	10-17 (13) 10-16 (13)

* Subadults only

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